Environmental Toolbox

Technical Module

Hazardous Material (HM) and Hazardous Waste (HW) Management

Objectives

- Understand the importance of hazardous material (HM) and hazardous waste (HW) management.
- Be familiar with common HM/HW management components
- Understand environmental officer (EO) responsibilities concerning HM/HW activities
- Develop knowledge about the risks, regulations and preventive measures in the handling of HW

Overview

- Planning considerations for HM and HW storage areas
- Collection
- Secondary Containment
- Segregation
- Emergency Preparedness
- Inspections
- Recordkeeping
- Container requirements
- Marking and Labeling
- Handling
- Transportation
- Recovery
- Recycling
- Disposal

Definitions

- Hazardous Material (HM) and Hazardous Waste (HW)

  “Any material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a real hazard to human health or the environment.”

- Hazardous Waste (HW)

  "*Any material considered discarded, abandoned, or unusable that may pose a real hazard to human health or the environment.*"

Significance and Benefits

Good HM/HW management can

- Enhance mission accomplishment
- Contribute to force health protection by preventing
  - Direct health problems
  - Contamination of the environment
- Promote good relations with the host nation (HN)
- Free up resources for the mission (camp space, transportation, funds, etc.)

HM and HW Management Objectives

- Use alternative nonhazardous substances, use less HM, and/or use HM that can be recycled
- Based on how responsive the supply system is, seek to reduce the inventory of HM, without risking mission readiness
- Prevent subordinate units from stockpiling HM and ensure that excess HM is turned back in for redistribution
- Ensure HM is used before the expiration of its shelf life (first in, first out), or extend the shelf life of the substance when appropriate
- Ensure HM is properly stored and safeguarded
- Reuse or recycle HM if possible
- Ensure waste streams are segregated to prevent HW from mixing with nonhazardous waste
- Ensure HW is properly disposed of

HW Management Plan

- Analyze the situation
- Develop preliminary HW estimates
- Categorize HW requirements
- Evaluate HW management capabilities
- Generate solutions
- Designate responsible parties and integrate waste management tasks into plans and orders

HM and HW Management Plan: EO Responsibilities

- Work together with the logistics staff officer, engineer staff officer, health officer and other staff members to effectively manage HM and HW
- Assist other officers in developing the HM management plan and incorporate relevant HM-related information within the HW management plan and standard operating procedures (SOP)
- Establish the standards and requirements for conducting inspections as a means of ensuring that established management practices are followed

HM Transformation into HW

Expired

Discarded

Unusable

Mixtures

Contamination

Examples of HW in Operations

- Batteries
- Aerosol cans
- Light bulbs
- Pesticides
- Flameless ration heaters
- Maintenance waste
- Paints
- Range and ammunition residues
- Radioactive waste
- Chemical, Biological, Radiological and Nuclear (CBRN) waste
- Used oil
- Used antifreeze
- Used electrical equipment
- Materials that contain asbestos
- Sludge resulting from wastewater treatment
- Incinerator ash
- Debris and residue from spill cleanup or remediation efforts
- Medical (healthcare) waste

Planning Considerations for HM and HW Facilities

- Location relative to
  - Sensitive environmental areas
  - Drinking water source(s)
  - Troop concentrations
  - Camp boundaries
  - Access to accommodate transportation vehicles
  - Topography

Planning Considerations for HM and HW Facilities (continued)

- Size
  - Should be based on the anticipated storage needs, derived from the types and quantities of HM and estimated consumption rates
  - The area should be designed, constructed, maintained, and operated to minimize the risk of a fire, explosion, or any unplanned release of HM/HW
- Only HM/HW that is properly identified, documented, marked and packaged is allowed into the HM/HW facilities
- Report unidentified HM/HW to your chain of command immediately and obtain guidance on testing and temporary storage
- The HW/HM facility, including its secondary containment, should be adequately covered
  - To keep precipitation out of the storage area
  - To prevent stored HM/HW from being exposed to the elements

Planning Considerations for HM and HW Facilities (continued)

- Access to the storage area should be controlled by either 24-hour monitoring or barriers that will restrict entry

- Use control measures such as signs, rope, yellow and black cautionary tape, and fencing to restrict access and control activities in and around the sites

- The area should be properly designated as a HM/HW facility, with signs in all necessary languages, posted on all sides which state cautions such as :

  "HAZARDOUS WASTE STORAGE AREA – DANGER UNAUTHORIZED PERSONNEL KEEP OUT"

  "NO SMOKING”

Example of HW facility

- Signage
- Accumulation log
- Inspection

Planning Considerations for HM/HW Facilities: EO Responsibilities

- Work with supply and logistics officers to make sure HM/HW is managed properly, for example
  - Monitor and inspect storage areas regularly
  - Be aware of HM/HW transportation plans
- EO primary responsibilities:
  - Spill prevention – work with supply personnel to ensure that equipment for managing (properly storing, containing and disposing) HM/HW is available
  - Spill response – perform planning, training, resourcing, and reporting requirements
  - Recordkeeping – coordinate with HM/HW facilities personnel to ensure inventory records are maintained and available

Collection

- Hazardous waste should be collected at or near the point of generation. This is the Hazardous Waste Accumulation Point (HWAP)
- The waste generator is responsible for the proper accumulation, maintenance, and housekeeping of the HWAP
- Accumulated waste should be transferred to a hazardous waste storage area (HWSA)

EO Responsibilities

- Be aware of the location of all HM/HW facilities (HWAPs, HM/HWSAs)
- Make sure that all HM/HW facilities have appropriate equipment to respond to any on-site emergency
- Make sure that all necessary personnel have proper training and appropriate PPE
- Regularly monitor and inspect collections sites
- Maintain good records

Secondary Containment

- Secondary containment for all containers is required to prevent the spread of spills

- Secondary containment must have the capacity to contain 10 percent of the total volume being stored or 110 percent of the volume of the largest container, whichever is greater

EO Responsibilities

- Be aware of secondary containment instructions
- Monitor regularly that secondary containment is in place in HM/HW facilities, that it is the right size, and uses proper material
- Make sure that backup secondary containment materials are available

Segregation

- HM and HW must be segregated to prevent incompatible materials or wastes from coming into contact in the event of a leak or spill, and producing an adverse chemical reaction or toxic fumes

- HM and HW are generally segregated into four major sections: reactives, flammables, corrosives, and toxics

- The following general incompatibilities should be avoided through segregation:
  - Reactives from flammables
  - Acids from bases
  - Corrosives from flammables
  - Oxidizers from everything
  - Organic reactives from inorganic reactives

Segregation

Here is an example of HM segregated into the four basic categories

Reactives	*Flammables*	*Corrosives*	*Toxics*
Chlorination kits	Chemical agent resistant coating–toxic	Battery acids	Grease
Decontaminates	Class III and V waste	Carbon remover	Insect repellants
Lithium (batteries)	Cleaning compounds	Degreasers	Lubricants
Magnesium	Deicing agents	Paint strippers	Oils
Sodium	Fuels	Rust removers	Oil contaminated solids
Zinc powder	Lacquers/varnishes	Radiator leak compounds	Paint primers
	Paints	Rust removers	
	Paint thinners	Weapons cleaners	
	Parts cleaners		
	Sealants		
	Solvents		
	Waste fuels		
	Windshield cleaners		

Example of Storage Segregation Chart

DANGEROUS GOODS & COMBUSTIBLE LIQUIDS STORAGE COMPATIBILITY CHART

Class or Subsidiary Risk	FLAMMABLE GAS 2	NON-FLAMMABLE NON-TOXIC GAS 2	TOXIC GAS 2	OXIDIZING GAS 2	FLAMMABLE LIQUID 3	FLAMMABLE SOLID 4	SPONTANEOUSLY COMBUSTIBLE 4	DANGEROUS WHEN WET 4	OXIDIZING AGENT 5.1	ORGANIC PEROXIDE 5.2	TOXIC 6	CORROSIVE 8
FLAMMABLE GASES	OK TO STORE TOGETHER	OK TO STORE TOGETHER	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
NON TOXIC NON FLAMMABLE GASES	OK TO STORE TOGETHER	OK TO STORE TOGETHER	OK TO STORE TOGETHER	OK TO STORE TOGETHER	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
TOXIC GAS	SEGREGATE At least 3m	OK TO STORE TOGETHER	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
OXIDIZING GAS	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
FLAMMABLE LIQUIDS + COMBUSTIBLE LIQUIDS	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	OK TO STORE TOGETHER	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	ISOLATE	SEGREGATE At least 5m	SEGREGATE At least 3m
FLAMMABLE SOLID	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 3m	ISOLATE	SEGREGATE At least 3m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES
SPONTANEOUSLY COMBUSTIBLE	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	OK TO STORE TOGETHER	SEGREGATE At least 5m	SEGREGATE At least 5m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 3m
DANGEROUS WHEN WET	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	OK TO STORE TOGETHER	SEGREGATE At least 5m	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 5m
OXIDIZING AGENT	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	KEEP APART	SEGREGATE At least 5m	SEGREGATE At least 5m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES	ISOLATE	SEGREGATE At least 3m	SEGREGATE At least 3m
ORGANIC PEROXIDE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	ISOLATE	OK TO STORE TOGETHER	ISOLATE	SEGREGATE At least 3m
TOXIC SUBSTANCES	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 3m	ISOLATE	OK TO STORE TOGETHER	SEGREGATE At least 5m
CORROSIVE	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 5m	SEGREGATE At least 3m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES	SEGREGATE At least 3m	SEGREGATE At least 5m	SEGREGATE At least 3m	SEGREGATE At least 3m	SEGREGATE At least 5m	MAY NOT BE COMPATIBLE CHECK MSDS AND NOTES

Segregation

EO responsibilities

- Make sure that HM/HW are segregated properly
- Be aware of
  - The most common types of HM used in the operation and their properties
  - Segregation instructions (Use segregation charts or Safety Data Sheets (SDS))
  - Where to find segregation information
  - The need to identify and separate HM and HW from other non-hazardous material and waste
- Train necessary personnel related to HM/HW segregation

Elements of a European Union (EU) Safety Data Sheet (SDS)

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure controls/ personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information

Emergency Preparedness

- HM/HW facilities must have a posted spill response plan that describes the proper actions to take (to include immediate notification and reporting requirements and points of contact (POCs)), and the proper use of the appropriate equipment to respond to any on-site emergency

- The spill response plan and use of equipment should be rehearsed (for example, simulating a spill incident) to ensure personnel working within HM/HW facilities understand the procedures

EO responsibilities

- Refer to the Spill Prevention and Response Planning technical module of this toolbox

Inspections

EO Responsibilities

- Monitor all HW facilities within your unit and/or assigned areas to ensure all requirements are being met and that containers remain in good condition
- Immediately correct any noted deficiencies
- Maintain a record of inspections

Recordkeeping

EO Responsibilities

- Maintain an accurate inventory to include tracking the storage duration for all HW
- Maintain a record for each container that tracks the type and amount of waste added; a copy of the record accompanies the container when it is transferred

Records help verify waste characterization before the waste is disposed of and prevent the need to sample the waste in the containers

Container Requirements

- Collect HW in containers that meet United Nations (UN) requirements for storage and transportation, whenever possible (check the SDS for the compatible type of container for that specific waste stream)
- The best container is often the original container that a material was shipped in, as long as it is capable of being closed
- In general, steel drums should be used for toxic and flammable waste; and polyethylene for corrosive acids or bases, and oxidizers
- When containers are reused, any labels or markings that no longer apply to the new content should be removed or covered over; and the containers should be relabeled as appropriate

Container Requirements

- Containers used to collect HW must be kept closed when not adding or removing waste
- When filling a container with liquid waste, ensure adequate headspace remains to allow for expansion of the waste

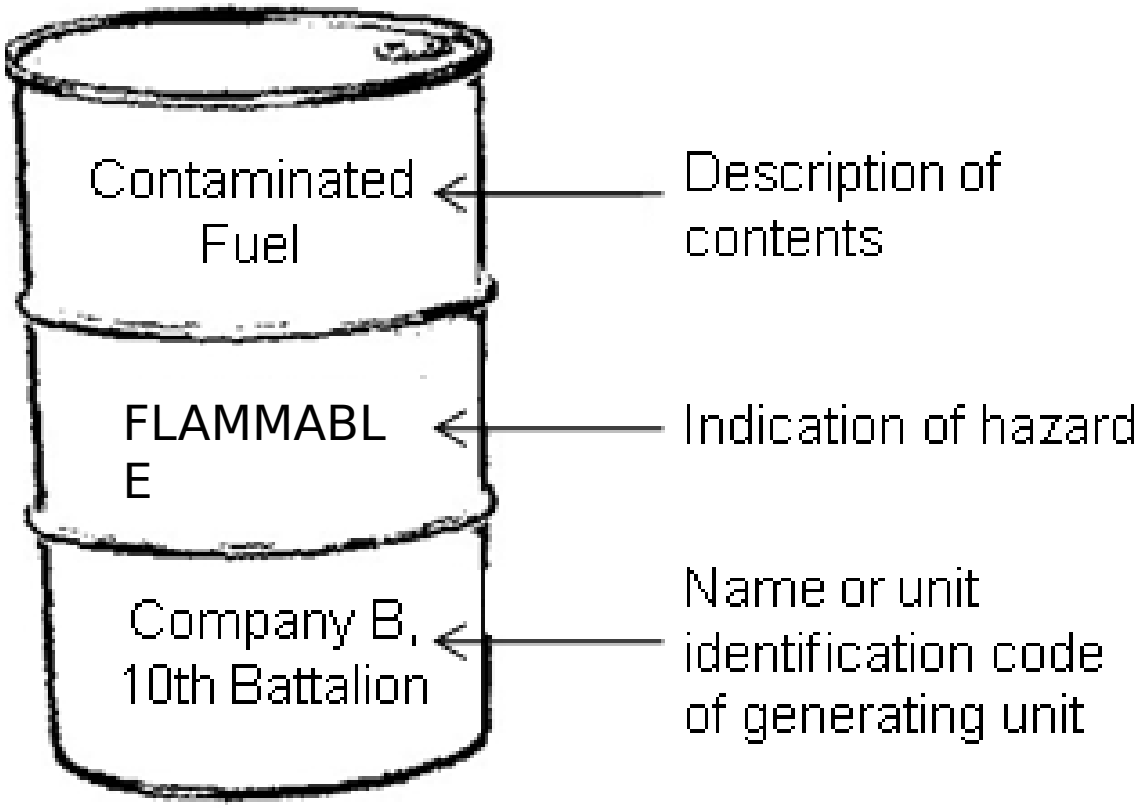
EO Responsibilities

- Be aware of container requirements for different HW in different conditions (e.g., hot and cold climates)
- Monitor regularly
- Make sure that all containers are in good condition, closed and compatible with the content

Marking and Labeling

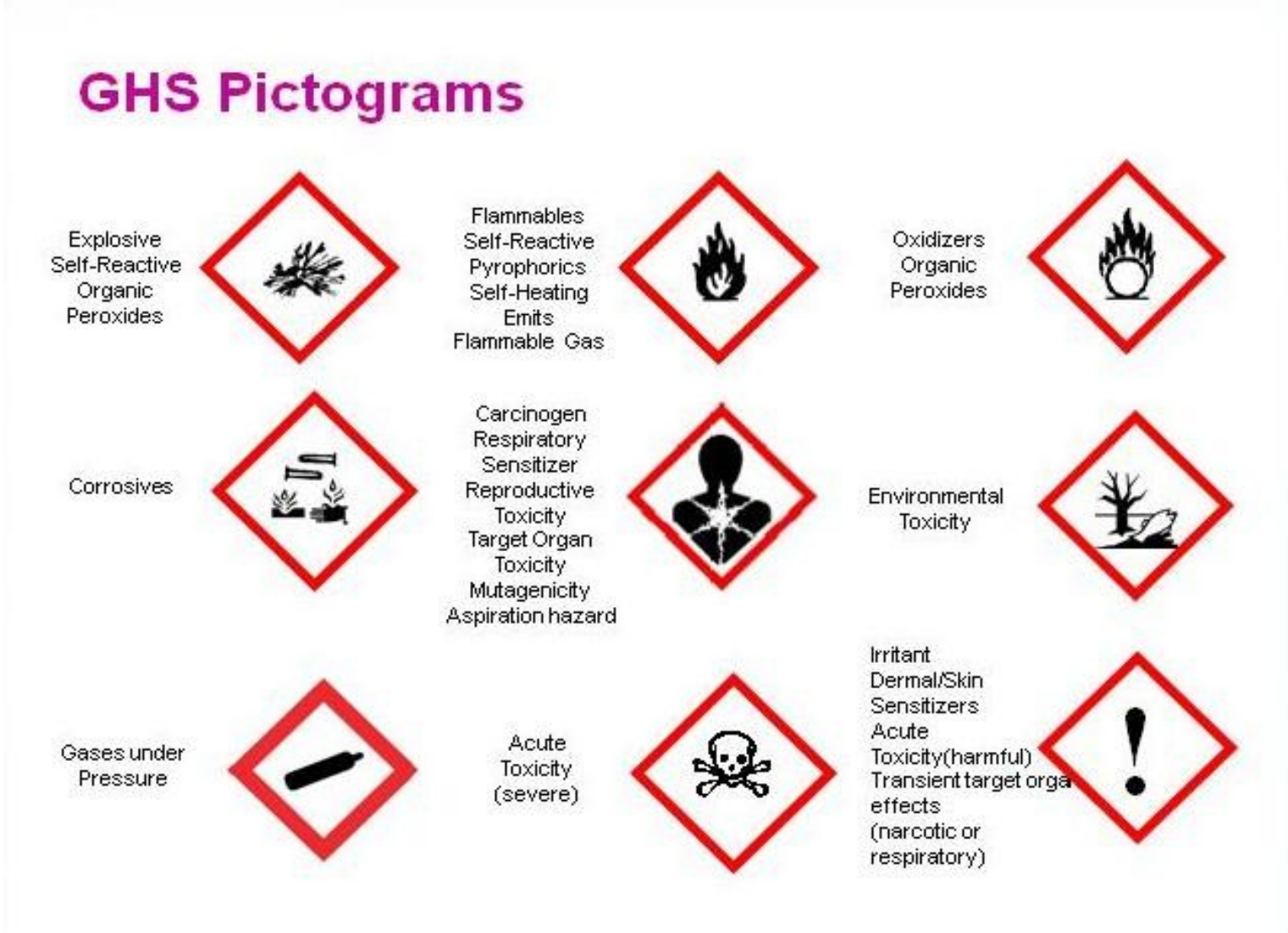
Container kept closed.

Container in good condition and compatible with contents.



Labeling of HM and HW

EU CLP-regulation / Global Harmonized System (GHS)



Marking and Labeling

- Each container of waste is marked or labeled with its contents (for example, "used oil" or "contaminated soil"), the hazards of the material (such as “flammable"), and the generating unit designation or unit identification code
- The container should be marked with the date that waste is actually placed in the container to indicate when accumulation began
- The containers should be arranged in the HWAP or HWSA so that the markings are facing outward for ease of viewing

EO responsibilities

- Be aware of marking and labeling requirements
- Recognize labels
- Make sure that all containers are properly marked and labeled

Handling

- An important aspect of handling HM and HW is correctly identifying the hazards associated with each individual chemical to minimize the risks to soldiers and the environment

- Hazardous characteristics for HM are found on the SDS for each substance.

- PPE is the primary means of safeguarding human health when handling HM and HW

Handling

EO responsibilities

- Include information on waste stream names and synonyms, the specific waste characterization, and handling or management procedures within the unit HW SOP
- Be prepared to respond to subordinate units requiring further information or clarification
- Be aware of SDS content and location

Transportation

- HW shipments must comply with all HM and HW transportation requirements in theater
- Transporters of hazardous cargo must be certified

EO Responsibilities

- Work with transport personnel to ensure HM/HW is properly classified, labeled and packaged
- Name, classification and other needed information must be correctly marked on transport documentation
- Maintain copies of documentation for tracking and record keeping purposes

Example of Labeling of HM/ Dangerous Goods Transportation

Classes of HM/ dangerous goods

1. Explosives
2. Gases
3. Flammable and combustible liquids

4.1 Combustible and self-reactive

4.2 Spontaneously combustible

4.3 Water Reactive

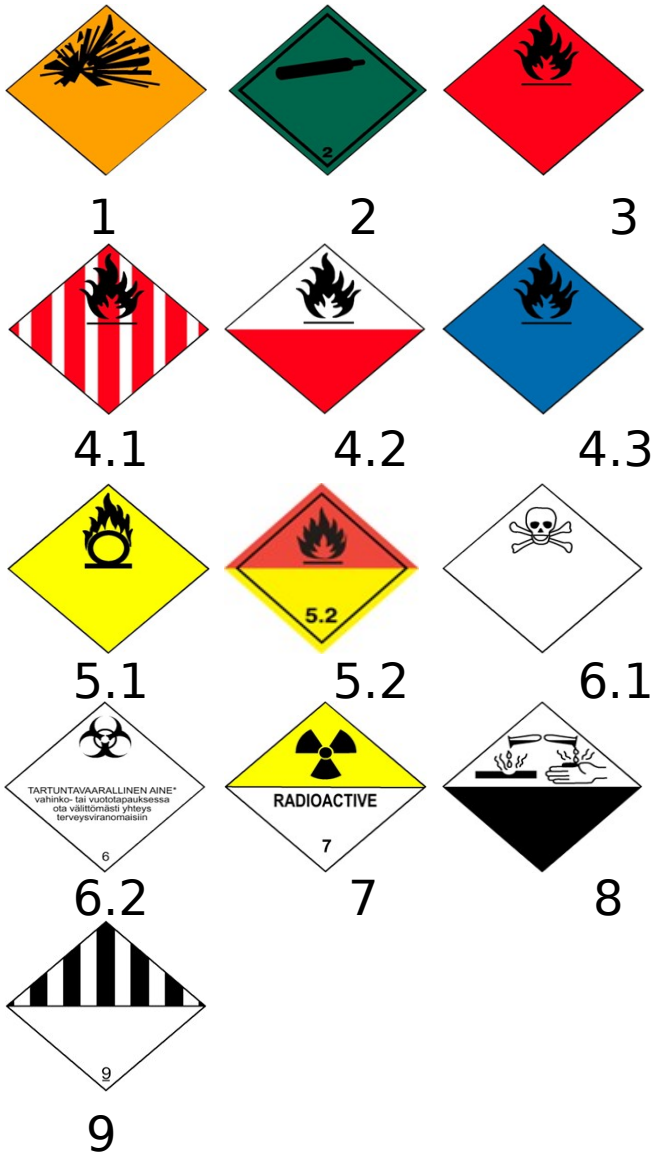
5.1 Oxidizing substances

5.2 Organic peroxides

6.1 Poisonous (toxic) substances

6.2 Infectious substances

7. Radioactive materials
8. Corrosives
9. Miscellaneous dangerous substances



Recovery and Reuse

- Recovery aims to divert waste material from waste streams to reduce the overall amount of waste requiring disposal
- Reusing HM is the easiest way to reduce the amount of HW requiring disposal
  - Recyclable HM can be stored until the means for recycling, either through contracting or a local recycling market, is established
  - Used-oil blenders can be used to blend used engine oil (only from diesel engines) into the fuel tanks of vehicles and generators that burn diesel fuel in accordance with technical guidance
  - Oil that cannot be used for its intended purpose may be transferred through a government contract to local vendors for use as fuel in various manufacturing processes (such as oil refineries)
  - Used oil can be converted into fuel or reused as a fuel source to generate hot water or heat with specific devices

Disposal

- The primary means for disposing of hazardous waste within a theater of operations will generally be through a qualified contractor
- In some cases, disposal capability will be developed within the camp, such as incineration
- If local contractors cannot be used, waste must be transported to a qualified disposal facility

Conclusions

Good HM/HW management can

- Enhance mission accomplishment
- Contribute to force health protection by preventing
  - Direct health problems
  - Contamination of the environment
- Promote good relations with the host nation (HN)
- Free up resources for the mission (camp space, transportation, funds, etc.)